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Sixty fourth- and fifth-grade children listened to six series of six sentences each, with each sentence in a series containing the same artificial word. The task was to assign to the artificial word a meaning which would fit all sentence contexts in the series. Preliminary data provided an estimate of the probability that a particular sentence, presented in isolation, would elicit a correct response. The sentence most likely to elicit a correct response in a particular series was called the "best" sentence. Two presentation orders were used: from best to worst and worst to best. There were two response conditions: one in which the subject responded after each sentence in a series, and one in which he responded only after hearing the entire series. Analysis of variance indicated that significantly more correct responses occurred with the best-to-worst presentation order. Number of responses and the interaction of this factor with presentation orde r were nonsignificant effects. Further analysis suggested that, with the worst-to-best order, early sentences tended to interfere with normal processing of subsequent sentences. Tables and references are included. (Author/CM)

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The Identification of Word Meaning from Sentence Contexts: An Effect of Presentation Order

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ABSTRACT

An experiment was performed to explore the usefulness of Werner and Kaplan's Word-Context Test as a research tool in further studies of sentence comprehension and retention. Fourth and fifth grade children listened to series of sentences, with each sentence in a series containing the same artificial word. The task was to assign to the artificial word a meaning which would fit all sentence contexts in the series. If a meaning met this criterion, it was considered a correct response.

Preliminary data provided an estimate of the probability that a particular sentence, presented in isolation, would elicit a correct response. The sentence most likely to elicit a correct response in a particular series was called the "best" sentence. Two presentation orders were used -- from best to worst and vice versa. Furthermore, there were two response conditions. In the multiple response condition, S responded after each sentence in a series, whereas in the single response condition, S responded only after hearing the entire series. The two presentation orders and two response conditions comprised a two-by-two factorial design, with four groups of 15 Ss, balanced for sex and grade level. The dependent variable was the number of lists for which S produced a correct response after hearing the entire list.

Analysis of variance indicated that significantly more correct responses occurred with the best-to-worst presentation order. Number of responses and the interaction of this factor with presentation order were nonsignificant effects. Further analysis suggested that, with the worst-to-best order, early sentences tend to interfere with normal processing of subsequent sentences. Inaccurate memory of the early contexts may account for this interference.

Recent interest in the process of comprehending speech has led to a number of experiments in which children and adults have listened to single, unrelated sentences. Although this work has produced interesting results and is worth pursuing further, there is also a need to develop experimental tasks which require the subject to listen to more than one sentence at a time and to relate the sentences to each other somehow. The comprehension and retention of individual sentences may be quite different under these circumstances. One task with interesting possibilities is the Word-Context Test used by Werner and Kaplan (1952) in their research on the child's acquisition of word meaning.

Basically, the Word-Context Test works like this. The subject is presented with a series of sentences, each containing the same artificial word. One series of sentences is shown in Table 1. The task is to assign a meaning to the artificial word which will fit all sentences in the series. That is, the subject has to identify the meaning of the unknown word by considering the different sentence contexts in relation to each other.

The experiment we have done with the Word-Context Test is based on some data collected previously by Harriet Anster (1966). Anster obtained an estimate of the probability that each sentence, by itself, would elicit a correct interpretation of the artificial word -- an interpretation which would fit all sentences in the series. The estimate of this probability is simply the proportion of subjects who responded correctly when each sentence was presented in isolation. On the basis of these data, one can order the sentences in a series from highest to lowest probability or

vice versa. Our experiment involves a comparison of these two presentation orders. We have called them best-to-worst and worst-to-best respectively. (The sentences in Table 1 are ordered from best-to-worst.)

The rationale for this experiment may be explained rather circuitously as follows. When a subject suggests a meaning for the artificial word which does not fit all the contexts he has encountered, there may be at least two reasons for his failure. First, a given context may so dominate the subject's thinking that he does not take into account the contexts which he has previously considered. In other words, there is a kind of recency effect, with the response fitting the latest context but not those which came earlier. On the other hand, encounters with previous contexts might be so dominant that the subject suggests a meaning which fits the earlier sentences but does not fit the latest one, unless that sentence is distorted somehow. This would represent a kind of primacy effect. In either case, the subject fails to integrate adequately the information from all the sentences.

Werner and Kaplan (1952) found evidence that children under 11 years make both kinds of error -- especially primacy errors -- even when the sentences are presented in writing and previous contexts are allowed to remain in sight. Werner and Kaplan interpret this finding to mean that there is a lack of differentiation between a particular word and the context in which it occurs. Thus the children do not preserve the integrity of each context or the relative invariance of word meaning from one context to another. It could be that children have trouble perceiving or remembering sentences in a way which permits the appropriate kind of

integration to occur. Perception and memory would become especially important factors if the sentences were presented orally in a single run through the series.

We thought we might learn something about the manner in which perception and memory interact by seeing whether the primacy or the recency effect is more prominent with oral presentation. If early contexts override later ones, this might suggest that retrieval of past information is not as much of a problem as the accurate perception of new sentences. On the other hand, if recent sentences are unduly influential, then perhaps memory is the bigger problem after all.

One way to assess the differential influence of earlier and later contexts is to compare the best-to-worst and worst-to-best orders. With a strong primacy effect, the best-to-worst order should produce more correct responses at the end of a series, because the subject would tend to stick with an early hypothesis about the artificial word's meaning and there is a high probability that it would be correct. The worst-to-best order should be more helpful if there is a strong recency effect.

It occurred to us that the number of responses required of the subject within a series might also affect performance. By requiring a response after each sentence, perhaps we could promote retention of early information, either strengthening the primacy effect or helping the subject to succeed in relating early sentences to later ones. Conversely, if the subject responded only after hearing the entire series, he might be less inclined to get fixated on an early hypothesis, or he might simply forget about the early sentences altogether.

In our experiment, the two presentation orders and two response conditions comprised a two-by-two factorial design, with four groups of 15 subjects, balanced as closely as possible for sex and grade level. The subjects were fourth and fifth grade children in Berkeley, drawn from basically the same population that Amster had used in establishing norms for each sentence. These children were tested individually, and every child heard six series of sentences, with six sentences in each series. The dependent variable was the number of series in which the subject correctly identified the meaning of the artificial word after hearing the entire series.

The means for all conditions of the experiment are contained in Table 2, and Table 3 summarizes an analysis of variance. The only significant effect is that of presentation order. On the average, the best-to-worst order produced one more correct response per subject than the worst-to-best order.

Primacy seems to have a greater effect than recency. Performance was better in the best-to-worst condition, where early sentences were quite helpful. In the worst-to-best conditions the early sentences not only failed to elicit correct responses but they actually tended to interfere with the subjects' use of the better contexts near the end of the series.

The interference effect becomes evident in a closer analysis of data from the group that responded after every sentence in the worst-to-best order. We can look at the frequency of correct responses elicited by the best sentence when the subject had not already hit upon a correct response. This frequency may be expressed as a percentage deviation from the frequency predicted by Amster's norms for isolated sentences. It was possible

to obtain an average deviation score for each subject. The group mean of these scores was -24, which is significantly lower than the expected value of zero -- $t(14) = 2.84$, $p<.02$ two-tailed. In other words, the subjects did not respond as well to the best sentence at the end of a series as they might have with no preceding contexts.

What do these results tell us about the relationship between memory and perception in the processing of sentences? A tentative answer is suggested by one additional finding. Subjects who received the worst-to-best order and responded after each sentence usually did not stick with an incorrect response that was elicited by an early context. apparently they could perceive the later contexts with enough accuracy to recognize that an earlier response was no longer acceptable. Having done that much, however, these subjects were often unable to make further effective use of the last sentence -- not to mention those which had come before it. At this point, it was not unusual for a subject to suggest a meaning which fit none of the contexts, or to respond with a word which had actually been part of a context, or to end up making no response at all.

It seems reasonable to conclude that a major obstacle to the relating of sentences in our experiment was the form in which the contexts were remembered. Some observations froma pilot study showed that sentences may lose their structural integrity very rapidly in memory. Once in a while, without any warning, we would ask a child to recall all the sentences he had heard in a series. Recall was rather poor. Sometimes elements from different sentences were recombined to form new sentences, or entirely new elements were introduced. Now suppose that, in going through a series

from worst-to-best, the subject realizes that he must abandon an early response. If his search for a new response is influenced by his distorted memory of preceding sentences, then it is not surprisong that performance suffers.

This experiment with the Word-Context Test has revealed some aspects of sentence-comprehension and retention which might not have shown up if the stimulus item had been a single isolated sentence. The impact of early sentences on the processing of later ones may be an important consideration in many instructional situations which require listening comprehension. Of course, it remains to be seen just how har our findings may be generalized to other materials and other populations of subjects.

TABLE 1

Sample Series of Sentences from the Word-Context Test (Best-to-Worst Order)

1. A person who saves a baby from drowning in deep water has much SOLDEVE. (.79)*

2. You need SOLDEVE to fight with a boy bigger than you. (.57)

3. If you have SOLDEVE you will not cry when you get hurt. (.29)

4. If you do something bad and then tell the truth, you have SOLDEVE. (.14)

5. You need SOLDEVE when you start to do a hard job. (.07)

6. We all admire someone who has much SOLDEVE. (.07)

*Proportion of correct responses elicited by the sentence in isolation (from Anster, 1966). A correct response is any word which fits all six sentences in the position occupied by SOLDEVE.

TABLE 2

Mean Number of Correct Responses after Last Sentence in Series (N=15 per Cell)

Response condition	Presentation Order: Best-to-Worst	Presentation Order: Worst-to-Best
Multiple	5.13	4.13
Single	5.07	4.07

TABLE 3

Analysis of Variance for Correct Responses

Source	Sum of Squares	df	Mean Square	F	p
Order	15.0	1	15.00	11.81	<.01
Responses	0.1	1	0.10		
O x R	0.0	1	0.00		
Error	71.3	56	1.27		
Total	86.4	59			

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